MODE S EQUIPAGE REQUIREMENTS RECOMMENDATION

AIR TRAFFIC SUBCOMMITTEE
Aviation Rulemaking Advisory Committee

The Air Traffic Subcommittee (ATS), an entity of the Aviation Rulemaking Advisory Committee, has been asked to provide recommendations to the Federal Aviation Administration (FAA) regarding Mode S transponder equipage requirements for general aviation aircraft operating under Part 91 of the Federal Aviation Regulations (FAR). In connection with this task, the ATS convened a working group to receive and consider the latest information available on the subject. Target display problems associated with air traffic density such as lost radar targets, incorrect position and altitude reports, and other potentially serious effects resulting from deficiencies in the current radar system were addressed.

Aviation organizations represented on the working group are as follows: Aircraft Owners and Pilots Association, Airline Pilots Association, Air Traffic Control Association, Experimental Aircraft Association, General Aviation Manufacturing Association, General Aviation Pilots Association, Helicopter Association International, National Aeronautics Association, National Air Transport Association, National Association of State Aviation Officials and the Department of Defense.

Recommendations contained herein are based on facts received from aviation industry representatives and FAA officials.

BACKGROUND:

In 1969, the FAA determined that the radar beacon system in use at the time had flaws which technology could correct. Of concern was the problem of synchronous garble. Synchronous garble is caused when two aircraft simultaneously pass within the interrogation beam transmitted by a radar site. This phenomenon causes a loss of one or more targets on the controller's radar scope, or an incorrect altitude or position report (sometimes five or more miles from the actual position of the aircraft). Without accurate position and altitude data on aircraft, the controller's ability to efficiently manage aircraft under his control is diminished. Early on, the FAA discovered that improved ground based radar surveillance systems could provide vastly improved accuracy and integrity of position data relayed to air traffic control scopes. Based on the need for improved surveillance and beginning as a stand alone project (later made part of the National Airspace System (NAS) modernization plan), the Mode S system was developed to be the next generation of enhancement in radar surveillance of aircraft.

At the same time, it was determined that if the Mode S system was implemented in its entirety (namely, a homogenous environment with both Mode S ground sensor stations as well as airborne Mode S transponder equipment), tracking problems associated with increased aircraft density would be eliminated due to the selective interrogation

feature of the system. However, because of cost of equipage and then recent transition to the Air Traffic Control Radar Beacon System (ATCRBS), a high priority for the Mode S system was compatibility with airborne ATCRBS transponders.

In keeping with its NAS Plan and desired system end state, FAA promulgated the Mode S rule in 1987. Various amendments have been issued to the rule applicable to general aviation operations (Part 91). Currently the Mode S rule requires any new transponder installation after July 1, 1992, be a Mode S transponder. Non-electrical aircraft, balloons and gliders are exempt from this requirement.

DISCUSSION:

The ATS recognizes that the Mode S system is an integral part of the modernization of the NAS. However, two significant problems exist with respect to the current Mode S equipage requirement as it applies to general aviation aircraft.

First, Mode S ground sensor stations have experienced implementation delays. The original schedule for installation and certification of the first 137 ground sensors (which cover the largest terminal areas in the country) called for completion by January 1992. This date has now slipped to August 1995. These stations are the bulwark of the Mode S system. Without the ground sensors, a Mode S transponder operates as nothing more than a solid state ATCRBS transponder.

Second, the existing Mode S rule effectively exempts all existing ATCRBS transponder equipped general aviation aircraft from the requirement to install a Mode S transponder. In its present configuration, the rule allows an operator to repair his transponder indefinitely. Since FAA has not defined to what extent a repair becomes a new installation, if one intends to avoid the expense of equipping with Mode S, he can replace substantial portions of the transponder, thereby prolonging its life almost indefinitely, and still comply with the language of the rule.

The ATS recognizes that the FAA will is not satisfied with this technicality. However, we believe that an arrangement that provides for an eventual changeover to Mode S transponder equipage, albeit slowly, and will not penalize those who have already invested in and are making use of ATCRBS technology is possible. Specifically, require installation of Mode S transponders on newly manufactured, electrically equipped, type certificated aircraft after July 1, 1996.

There still appears to be a problem with ATCRBS transponder interrogation and reply (synchronous garble). The FAA has demonstrated that the problem will occur less often than it currently does due to a "thinner" more accurate beam used by the Mode S ground sensors to interrogate ATCRBS transponders. Although the FAA has conducted studies of synchronous garble, missing or incorrect position reports, and other problems associated with the current radar system, the studies presented to the ATS have not been sufficiently controlled to indicate that the lost target and synchronous garbling problems would not be eliminated with the implementation of Mode S ground sensors alone. Current data indicates a 97% chance of detection and display of a target whether transmitted to a Mode S ground sensor from a Mode S or ATCRBS transponder.

Even though the FAA intends to move to a homogenous Mode S environment, the working group is concerned over the requirement for general aviation aircraft to equip with Mode S transponders regardless of the airspace used. It may be true that some high density airspace areas will require the equipage of Mode S transponders. However,

there are many areas of the country where a Mode S transponder would not provide significant improvements in surveillance accuracy and integrity over the use of Mode S ground sensors alone.

The first Mode S sensor to be commissioned is at Fort Lauderdale, Florida in August 1992. According to FAA reports, general aviation traffic accounts for one third of the total operations at the Fort Lauderdale International Airport. We recommended that the FAA conduct studies of synchronous garble and missing/incorrect target data at Fort Lauderdale once the Mode S ground sensor is operational. Answers to the following questions would support further regulatory direction. What quantifiable deficiencies in target surveillance and integrity exist due to the present level of ATCRBS transponders? How much improvement would be realized by requiring Mode S transponders in this airspace? What system improvements would be realized from required Mode S equipage in this airspace? If the results of these studies, as well as, projections of future traffic densities indicate mandatory equipage would be beneficial, the airspace areas at which those benefits will be significant could be identified and regulatory action promulgated.

Adoption of this recommendation will limit mandatory equipage to specific areas where the system will benefit, rather than a mass requirement which would afford only specific benefit.

SUMMARY:

Recommendation #1- Change the requirements of FAR 91.215 so as to require installation of Mode S transponders on newly manufactured, type certificated aircraft after July 1, 1996.

Recommendation #2- Aircraft with electrical limitations, balloons and gliders should be exempt from the rule.

Recommendation #3- Conduct a study of the Mode S ground sensor at Fort Lauderdale to determine whether significant additional benefits would be derived from mandatory Mode S equipage in addition to the ground sensor versus the ground sensor alone. Publish a progress report within 6 months after the commissioning of the Fort Lauderdale Mode S ground sensor. Include in the report the expected completion date of the study. Examine the costs and benefits of linking equipage requirements to specific airspace areas needing such treatment.

The Air Traffic Subcommittee appreciates the opportunity to provide these recommendations and is ready to work on a NPRM to accomplish the above recommendations.

Respectfully Submitted,

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